

# 2005 NEC Guide Lines for Home Owner Doing Electrical Work on their Property



A brief summery of the most used code  
references for residential wiring

# State of Idaho

## Division of Building Safety Electrical Bureau

### Residential Electrical Inspection Checklist

Generally, **Idaho law** requires all electrical work to be performed by licensed electrical contractors and their employees. Homeowners, within limitations, are exempt from electrical licensing. A **home owner** is a person who physically performs electrical work on Their own primary or secondary residence and associated buildings. A request for a home owner electrical permit form with the required fees must be submitted to the Electrical Bureau before commencement of any electrical installation. All wiring shall be inspected before it is concealed and the installer shall notify the inspector when the wiring is complete, before the wiring is utilized and the associated space occupied. When an owner files for a Home Owners Permit form and inspection fees with the Electrical Bureau, that person is signing an affidavit that they own residence and that they personally and physically will perform all of the electrical work, including the laying out of such work.

STATE ELECTRICAL INSPECTORS ARE AVAILABLE WEEKDAYS ONLY

Between 7:30 am and 9:00 am

**Where wiring is concealed before inspection**, the person responsible for concealing the wiring shall be responsible for all costs resulting from uncovering and replacing the covering material.

- **A ROUGH-IN INSPECTION** must be made before any wiring is covered by insulation, sheetrock, paneling, or other materials. Underground wiring must be inspected before the trench is back-filled. Except for the final connection to switches, receptacles, and lighting fixtures, all ground wires and other wires in boxes must be spliced and pigtailed for the rough-in inspection.
- **A FINAL ELECTRICAL INSPECTION** is required when all wiring has been completed, all devices, lighting fixtures, and appliances have been installed and tested.

### PLAN YOUR WIRING PROJECT

*This brochure is only intended to be a general overview of residential electrical requirements. No claim is made that this information is complete or beyond question. Additional information and knowledge will be needed to properly install electrical wiring that is essentially free from fire and electric shock hazard. If you have questions after reading this brochure, please reference authoritative publications based on the 2002 National Electrical Code (the NEC).*

### General Circuitry

- **NEC 210.11 and 422.12** In addition to the branch circuits installed to supply general illumination and receptacle outlets in dwelling units, the following minimum requirements apply:
  - One 20-amp circuit for the laundry receptacles
  - One 20-amp circuit for the bathroom receptacles
  - One separate, individual branch circuit for central heating equipment
- **NEC 210.52** Receptacles installed in the kitchen to serve countertop surfaces shall be supplied by the two 20-amp circuits for the kitchen receptacles. **NEC 220.3** Requires that the general lighting circuit be provided at 3 volt amps per square foot ( 600 Square feet per circuit for a 15 amp circuit or 800 square feet for a 20 amp circuit).
- **NEC 300.3** All conductors of the same circuit, including grounding and bonding conductors, shall be contained in the same raceway, cable, or trench

- **NEC 408.4** All circuits and circuit modifications shall be legibly identified as to purpose or use on a directory located on the face or inside of the electrical panel doors.
- **07 NEC 240.3** The rating of the fuse or circuit breaker generally determines the minimum size of the circuit conductor, per the following table:

Fuse or Circuit	Minimum Wire Size	
Breaker Size	Copper	Aluminum
15 amp	14	n/a
20 amp	12	n/a
30 amp	10	8
40 amp	8	6
50 amp	6	4

Note: Conductors that supply motors, air-conditioning units, and other special equipment may have over current protection that exceeds the general limitations in the above chart.

- **NEC 406.3** Receptacle outlets shall be of the grounding type, be effectively grounded, and have proper polarity.
- **NEC 210.52** Generally, receptacle outlets in habitable rooms shall be installed so that no point measured horizontally along the floor line in any wall space is more than 6' from a receptacle outlet. You will need a receptacle within 6' of any door, fireplace, or similar break in the wall and then the next would need to be within 12' of the first. You may measure around corners. A receptacle shall be installed in each wall space 2 feet or more in width.
- **NEC 210.52** At kitchen countertops, receptacle outlets shall be installed so that no point along the wall line is more than 24" measured horizontally from a receptacle outlet in that space. You will need to install the first receptacle within 2' of the edge of the counter or sink and then the next within 4' of the first. Receptacles installed within cabinets do not count as one of these required receptacles.
- **NEC 210.52** A receptacle outlet shall be installed at each counter space 12" or wider, and at each island counter or peninsular space 24" by 12" or larger. Countertop spaces separated by, range tops, sinks or refrigerators are separate spaces
- **NEC 210.52 Outdoor receptacles**, accessible at grade level and no more than 6.5' above grade, shall be installed at the front and back of a dwelling.
- **NEC 210.52 Laundry Areas**, at least one receptacle outlet shall be installed for the laundry.
- **NEC 210.52 Basements and Garages**, at least one receptacle outlet shall be installed in addition to any provided for the laundry equipment.
- **NEC 210.52 Hallways**, 10 feet or longer shall have at least one receptacle outlet.
- **NEC 210.12** All branch circuits supplying 125-volt, 15 and 20 ampere outlets in dwelling unit bedrooms shall be protected by a listed arc-fault circuit interrupter device. Generally, these are circuit breaker type devices and cannot be installed on multi-wire branch circuits.

## Ground-Fault Protection

- **NEC 210.8** At dwellings, ground-fault circuit-interrupter (GFCI) protection shall be provided for all receptacle outlets installed in bathrooms, garages, grade-level portions of accessory buildings, crawl spaces, unfinished basements, kitchen countertops, wet-bar sinks, bathhouses and outdoors. Receptacles that are not readily accessible may be exempt from the GFCI requirement.
- **NEC 680.71** A hydro massage bathtub, (defined as a permanently installed bathtub with a re-circulating piping system, designed to discharge water upon each

use, and its associated components] shall have ground-fault circuit-interrupter protection.

- **NEC 680.71** All 125 volt receptacles not exceeding 30 amperes installed within 5 feet of the inside walls of the hydro massage bathtub shall be GFCI protected.
- **NEC 680.71** All equipment associated with a hydro massage bathtub shall be accessible without damaging the building structure or finish.

## Wiring Methods

- **NEC 314.23** All electrical boxes shall be securely supported by the building structure.
- **NEC 314.27** When boxes are used as the sole support for a ceiling paddle fan, they shall be listed and labeled for such use.
- **NEC 334.30** Type NM (nonmetallic) cable shall be secured at intervals not exceeding 4.5' and within 12" of each box. Flat cables shall not be stapled on edge.
- **NEC 314.17** The outer jacket of NM cable shall extend into the box a minimum of ¼ inch.
- **NEC 300.14** The minimum length of conductors, including grounding conductors, at all boxes shall be 6". At least 3" shall extend outside the box.
- **NEC 300.4** Where cables are installed through bored holes in joists, rafters, or wood framing members, the holes shall be bored so that the edge of the hole is not less than 1¼ inch from the nearest edge of the wood member. Where this distance cannot be maintained, or where screws or nails are likely to penetrate the cable, it shall be protected by a steel plate at least 1/16" thick and of appropriate length and width.
- **NEC 300.22** Type NM cable shall not be installed in spaces used for environmental air, however NM is permitted to pass through perpendicular to the long dimension of such spaces.
- **NEC 250.134; 314.4; 404.9** All electrical equipment, metal boxes, cover plates, and plaster rings shall be grounded. All switches, including dimmer switches, shall be grounded.
- **NEC 110.12 & 314.17** Unused openings in boxes shall be effectively closed. When openings in non-metallic boxes are broken out and not used, the entire box must be replaced.
- **NEC 110.14** Only one conductor shall be installed under a terminal screw. In boxes with more than one ground wire, the ground wires shall be spliced with a "wire tail" or "pig tail" attached to the grounding terminal screw of the device.
- **NEC 110.14** Splices shall be made with an approved splice cap or "wire nut" and shall be made in approved electrical boxes or enclosures. Wire splicing means for direct burial shall be identified for such use.
- **NEC 314.25 & 410.12** In a completed installation, all outlet boxes shall have a cover, lamp-holder, canopy for a luminaire, or device with an appropriate cover plate.
- **NEC 314.29** Junction boxes shall be installed so that the wiring contained in them can be rendered accessible without removing any part of the building.
- **NEC 314.16** The volume of electrical boxes shall be sufficient for the number of conductors, devices, and cable clamps contained within the box. Nonmetallic boxes are marked with their cubic inch capacity. Use the following table to properly calculate box size:

Conductor Size	14 gauge	12 gauge
For each separate insulated wire	2 in <sup>3</sup>	2.25 in <sup>3</sup>
All ground wires (combined)	2 in <sup>3</sup>	2.25 in <sup>3</sup>
For each device (switch/receptacle)	4 in <sup>3</sup>	4.4 in <sup>3</sup>
All internal cable clamps (combined)	2 in <sup>3</sup>	2.25 in <sup>3</sup>

**Sample Calculation: Four 14/2 w/ground NMB cables**

8 insulated wires	8X2	16 in <sup>3</sup>
All ground wires	1X2	2 in <sup>3</sup>
1 switch	1x4	4 in <sup>3</sup>
1 receptacle	1x4	4 in <sup>3</sup>
All clamps (combined)	1x2	2 in <sup>3</sup>
Total box volume required	16+2+4+4+2=	28 in <sup>3</sup>

- **NEC 410.8** Luminaries (lighting fixtures) installed in clothes closets shall have the following minimum clearances from the defined storage area (see the definition below):
  - 12" for surface incandescent fixtures
  - 6" for recessed incandescent fixtures
  - 6" for fluorescent fixtures
- **NEC 410.8** Storage space, as applied to an electrical installation in a closet, is the volume bounded by the sides and back closet walls and planes extending from the closet floor vertically to a height of 1.8 m [6 ft] or the highest clothes-hanging rod and parallel to the walls at a horizontal distance of 600 mm [24"] from the sides and back of the closet walls respectively, and continuing vertically to the closet ceiling parallel to the walls at a horizontal distance of 300 mm [12"] or the shelf width, whichever is greater.
- **NEC 410.8** Incandescent luminaires with open or partially enclosed lamps and pendant fixtures or lamp-holders are not permitted in clothes closets.
- **NEC 410-66** Recessed lighting fixtures installed in insulated ceilings or installed within 13 mm [1/2"] of combustible material shall be approved for insulation contact and labeled Type IC.
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## Equipment Listing and Labeling

- **Idaho Rules 07.01.10004.011** All electrical equipment, including luminaires, devices, and appliances shall be LISTED AND LABELED by a nationally recognized testing laboratory (NRTL) as having been tested and found suitable for a specific purpose. Underwriters Laboratories (UL) and the Canadian Standards Association (CSA) are two of the recognized agencies.
- **NEC 110.3** All electrical equipment shall be installed and used in accordance with the listing requirements and manufacturer's instructions.

## Electrical Services

**Always consult your power supplier,** for meter location and mounting height. Acceptable wiring methods and raceways for underground service entrance Conductors.

- **NEC 310-15 CONDUCTOR SIZES FOR 120/240 VOLT SINGLE-PHASE DWELLING SERVICES AND FEEDERS**

Copper	Aluminum	Service Rating
4 AWG	2 AWG	100 amps
1 AWG	2/0	150 amps
2/0	4/0	200 amps

- **NEC 110.14** Conductors of dissimilar metals shall not be intermixed in a terminal or splicing device unless the device is listed for the purpose. Listed anti-oxidant compound shall be used on all aluminum conductor terminations, unless information from the device manufacturer specifically states that it is not required.
- **NEC 300.7** Portions of raceways and sleeves subject to different temperatures (where passing from the interior to the exterior of a building) shall be sealed with an approved material to prevent condensation from entering the service equipment.
- **NEC 230.54** Where exposed to weather, service entrance conductors shall be rain-tight and arranged to drain.
- **NEC 300.4** Where raceways containing ungrounded conductors No. 4 or larger enter a cabinet, box, or enclosure, the conductors shall be protected by a conduit bushing providing a smoothly rounded insulating surface.
- **NEC 230.70** The electrical service disconnecting means shall be installed at a readily accessible location either outside a building or structure or inside nearest the point of entrance of the service entrance conductors.
- **NEC 230.70 & 240.24** Electrical panels shall be readily accessible and shall not be located in bathrooms or in the vicinity of easily ignitable materials such as clothes closets.
- **NEC 110.26** Sufficient working space shall be provided around electrical equipment. When the voltage to ground does not exceed 150 volts, the depth of that space in the direction of access to live parts, shall be a minimum of 3'. The minimum width of that space in front of electrical equipment shall be the width of the equipment or 30" whichever is greater. This workspace shall be clear and extend from the floor to a height of 6½ '. This space shall not be used for storage.
- **NEC 110.26** All workspaces shall be provided with illumination.

## Grounding

- **NEC 250.50** A premises electrical service shall be connected to any available grounding electrodes as in 250.52 to form the grounding electrode system
- **NEC 250.52 Grounding Electrodes**, Metal underground water pipe with 10 feet or more in contact of the earth (including well casings), Metal building frame, concentric encased electrode of 4 AWG copper conductor 20 feet long or 20 feet of ½ bare reinforcing bar within and near the bottom of a concrete footing, and 8 foot ground rods.

**An additional electrode must supplement the buried water pipe electrode.**

**NEC 250.64 & 250.66** The grounding electrode conductor shall be unspliced. The size is determined by the size of the service-entrance conductors, per the following chart:

Entrance Conductor Equivalent Size of Service		Size of the Grounding Electrode Conductor	
Copper	Aluminum	Copper	Aluminum
4 AWG	2	8	6
1 AWG	2/0	6	4
2/0 or 3/0	4/0 or 250	4	2

The conductor that is the sole connection to a rod, pipe or plate electrode is not required to be larger than #6 copper.

- **NEC 250.28** A main bonding jumper or the green bonding screw provided by the panel manufacturer shall be installed in the service panel to electrically bond the grounded service conductor and the equipment grounding conductors to the service enclosure.
- **NEC 250.104** The interior metal water piping and other metal piping that may become energized shall be bonded to the service equipment with a bonding jumper sized the same as the grounding electrode conductor.

### Underground Wiring

- **NEC 300.5** Direct buried cable or conduit or other raceways shall meet the following minimum cover requirements:

Direct Burial Cable	Rigid or Intermediate Metal Conduit	Non-Metallic Raceway (PVC)
24"	6"	18"
Residential branch circuits rated 20 amps or less at 120 volts or less and with GFCI protection at their source are allowed a minimum cover 12"		

- **NEC 300.5** Underground service laterals shall have their location identified by a warning ribbon placed in the trench at least 12" above the underground installation.
- **NEC 300.5** Where subject to movement, direct buried cables or raceways shall be arranged to prevent damage to the enclosed conductors or connected equipment.
- **NEC 300.5** Conductors emerging from underground shall be installed in rigid metal conduit, intermediate metal conduit, or Schedule 80 rigid nonmetallic conduit to provide protection from physical damage. This protection shall extend from 18" below grade or the minimum cover distance to the point of termination above ground.